

## Squat lobsters of the genus *Galathea* (Decapoda: Anomura: Galatheididae) associated with comatulid crinoids from the Ryukyu Islands, Japan

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**Abstract.**—Four species of squat lobsters (*Galathea amboinensis* de Man, 1888, *G. continua* new species, *G. inflata* Potts, 1915, and *G. leptochair* new species), all associates of comatulid crinoids, are described from material collected on coral reefs of the Ryukyu Islands. *Galathea continua* is found in association with *Capillaster multiradiatus*, *Clarkcomanthus littoralis*, *Comatella maculata*, *C. nigra*, *C. stelligera*, and *Comanthus gisleni*. It is distinguished from the other three species by the absence of a spine on the hepatic region lateral to the first transverse ridge of the carapace, the anterior margin of sternite 3 submedially produced into two spines instead of roughly bilobed, and epipods present on pereopod 1 only instead of pereopods 1–3. *Galathea leptochair* associated with *Phanogenia gracilis* is distinguished from *G. amboinensis* by much more slender pereopod 1, the carapace with four uninterrupted and three interrupted transverse ridges placed alternately instead of one interrupted and six uninterrupted ridges on the posterior half surface, and abdominal somites 2–4 with two uninterrupted instead of three uninterrupted transverse ridges. Coloration is also different in each of these species. A key to the four species is provided.

### Introduction

In a previous paper we reported that *Galathea amboinensis* de Man, 1888 and *G.*

*inflata* Potts, 1915 were common galatheid associates of crinoids on coral reefs of the Ryukyu Islands (Fujita & Baba, 1999). Since then, during extensive field work one of us (YF) has collected two additional galatheid species that are very much like the two previously reported species in color pattern and morphology. Close examination reveals that these are in fact undescribed species.

So far 17 species of the genus *Galathea* are known from the Ryukyu Islands (Stimpson, 1858, 1907; Ortmann, 1892; Miyake & Baba, 1966; Baba, 1972, 1989; Kamezaki *et al.*, 1988; Fujita & Baba, 1999; Minemizu, 2000; Kawamoto & Okuno, 2003; Osawa, 2004, 2006). Two of these are associates of crinoids. *Allogalathea elegans* (Adams & White, 1848), another crinoid associate, is also common in the Ryukyus but is not treated in this paper. Baba (1969) reported *Galathea inflata* Potts, 1915 from Amami-oshima of the Ryukyu Islands. However, it was removed from the synonymy of that species, on examination of material from the Moluccas that perfectly fit the original description of *G. inflata* (see Baba, 1979). One of the two new species, *Galathea continua*, is identical with this species and clearly different from *G. inflata* in morphology. However, their colorations are very much alike, so that the material of *G. inflata* reported by Fujita & Baba (1999) was reexamined and proved to be a mixture of the two species. The other new species, *Galathea leptochair*, is so close to *G. amboinensis* that morphological details are provided for *G. amboinensis* in order to separate it from the new species.

The terminology used in the text follows

that of Baba (2005). Carapace length indicates the postorbital carapace length. Rostrum breadth is the distance between posteriormost lateral incisions, and the length is between the rostral tip and the frontal margin. Pereopods 1 are measured in dorsal midline, and pereopods 2–4 are in lateral midline. The abbreviations used in the text include: Mxp3 = third maxilliped; P1 = first pereopod (cheliped); P2–4 = second to fourth pereopods (first to third walking legs). In the description, character states in the holotype, where necessary, are shown in brackets.

The type material is deposited in the collection of the Muséum national d'Histoire naturelle, Paris (MNHN). Host crinoids of the two new species are deposited in the Ryukyu University Museum, Fujikan, Okinawa, Japan (RUMF).

***Galathea amboinensis* de Man, 1888**

(Figs. 1, 2)

*Galathea amboinensis* De Man, 1888: 457, pl. 19: fig. 3 (type locality: Ambon; type not located). — Baba, 1979: 648 (Gorong Island, Moluccas, subtidal, on *Comanthina schlegelii* [currently either *Comaster schlegelii* or *C. nobilis*]). — Baba, 1988: 68, fig. 27 (Sulu Archipelago, shore). — Fujita & Baba, 1999: 112, fig. 1 (Okinawa, Ryukyu Islands, 5.5–29.8 mm, on 10 species of crinoids). — Fujita *et al.*, 2003: 80, figs. 2–11 (larvae) (Okinawa, Ryukyu Islands, subtidal, on *Capillaster multiradiatus*). — Davie, 2002: 60 (no record). — Poore *et al.*, 2008: 19, with unnumbered fig. (SW Australia, 96–101 m).

*Galathea minuta* Potts, 1915: 87, pl. 1, fig. 6 (type locality: off Mabuiagu Island, Torres Strait, 7 m, on *Comanthus annulatum* [= *C. timorensis*; currently either *C. parvicirrus* or *Clarkcomanthus littoralis*]; type not located).

**Material examined.**—One female (6.9 mm), Maeda-misaki, Okinawa-jima, Ryukyu Islands, on *Capillaster multiradiatus*, 7.7 m deep, 26.03.2002; 1 male (3.7 mm), same locality, 8.9 m deep, on *Capillaster multiradiatus*, 09.06.1997; 1 male (4.4 mm), Mizugama, Okinawa-jima, 7.1 m deep, on *Comanthus gisleni*, 01.12.1997; 1 female (7.9

mm), same locality, 9.7 m deep, on *Phanogenia gracilis*, 14.10.1996.

**Description.**—Carapace 0.9–1.0 times as long as broad; no epigastric spines; small spine lateral to first transverse ridge, situated on hepatic region; setiferous ridge directly behind anterior cervical groove arising from base of anterior-most of branchial marginal spines, not extending to median part of carapace (extension toward median part interrupted by anterior cervical groove); 7 major transverse ridges on posterior half of carapace, occasionally with interrupted ridges between first and second; sixth interrupted, others uninterrupted. Lateral margin with 2 spines in front of and 5 or 6 spines behind distinct anterior cervical groove (2 or 3 spines on anterior branchial margin); first at anterolateral angle, slightly posterior to level of lateral limit of orbit; small spine on frontal margin between lateral orbital spine and anterolateral spine of carapace. Lateral orbital angle ending in small but distinct spine, infraorbital margin produced anteriorly, with lateral denticles. Rostrum broad triangular, 1.5 times as long as broad, length 0.5–0.6 that of, breadth 1/3 that of carapace; dorsal surface with small setiferous ridges; lateral margin with 4 deeply incised teeth, each with stiff seta at mesial base.

Pterygostomial flap unarmed on surface, anteriorly rounded.

Sternal plastron slightly shorter than broad, lateral extremities divergent posteriorly. Sternite 3 1.7–2.5 times broader than long, anterior margin bilobate. Sternite 4 half as long as broad, length 2.5 times that of, breadth 2.4–3.0 times that of sternite 3; surface with 2 or 3 transverse ridges, posterior-most uninterrupted. A few oblique ridges on sternite 5, smooth on sternites 6–7.

Tergites of abdominal somites 2–3 with 3 transverse ridges. Telson 0.7 as long as broad, indistinctly subdivided. Two pairs of male gonopods.

Basal article of antennular peduncle with 3 spines, all well developed, distodorsal larger; ultimate article with a few short setae dis-

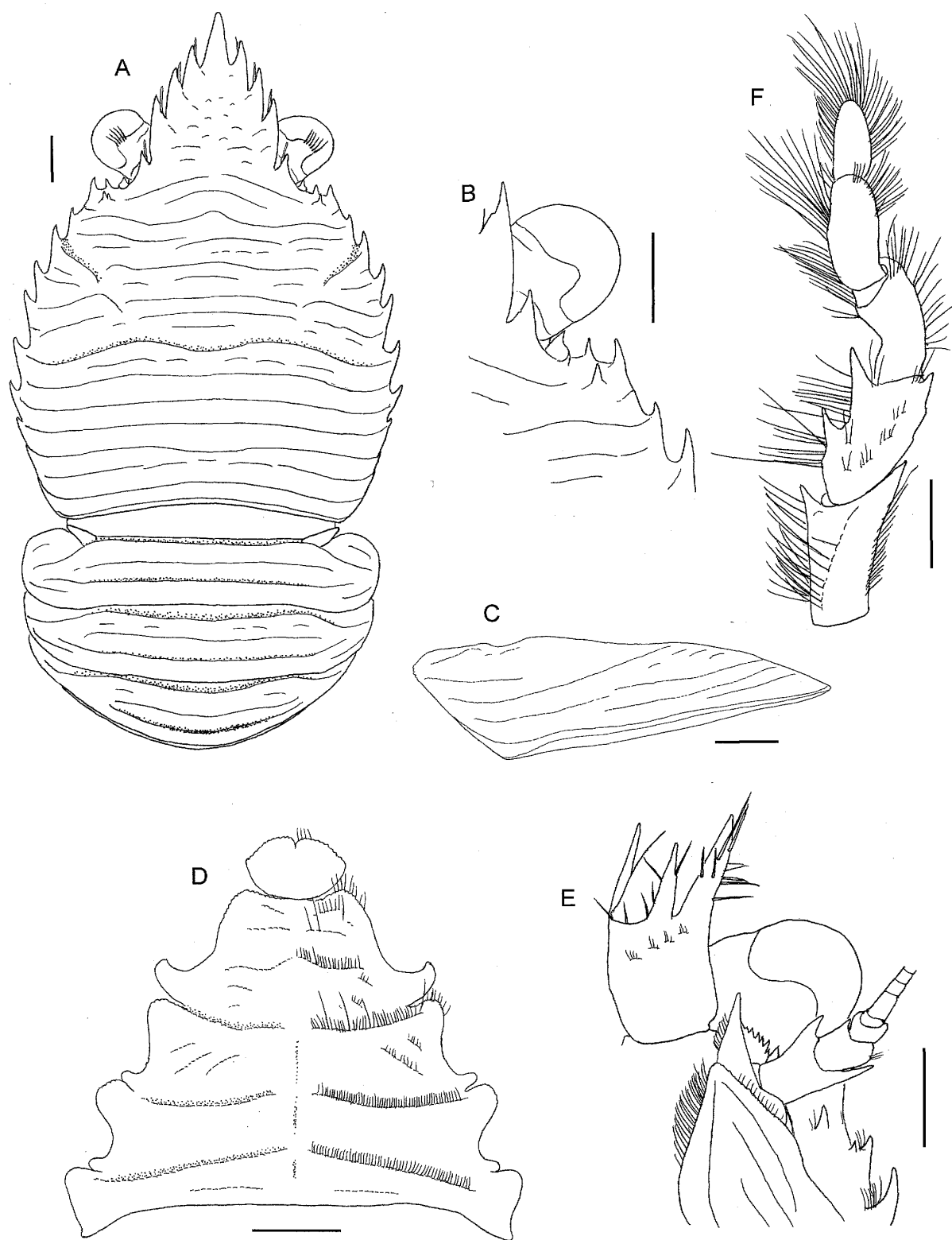


Fig. 1. *Galathea amboinensis* de Man, 1888, female (6.9 mm) from Maeda-misaki: A, carapace and abdomen, dorsal; B, carapace, anterolateral part, right; C, pterygostomian flap; D, sternal plastron; E, anterolateral part of cephalothorax, showing antennule, antenna and anterolateral part of carapace, ventrolateral; F, Mxp3, left, lateral. Scales = 1 mm.

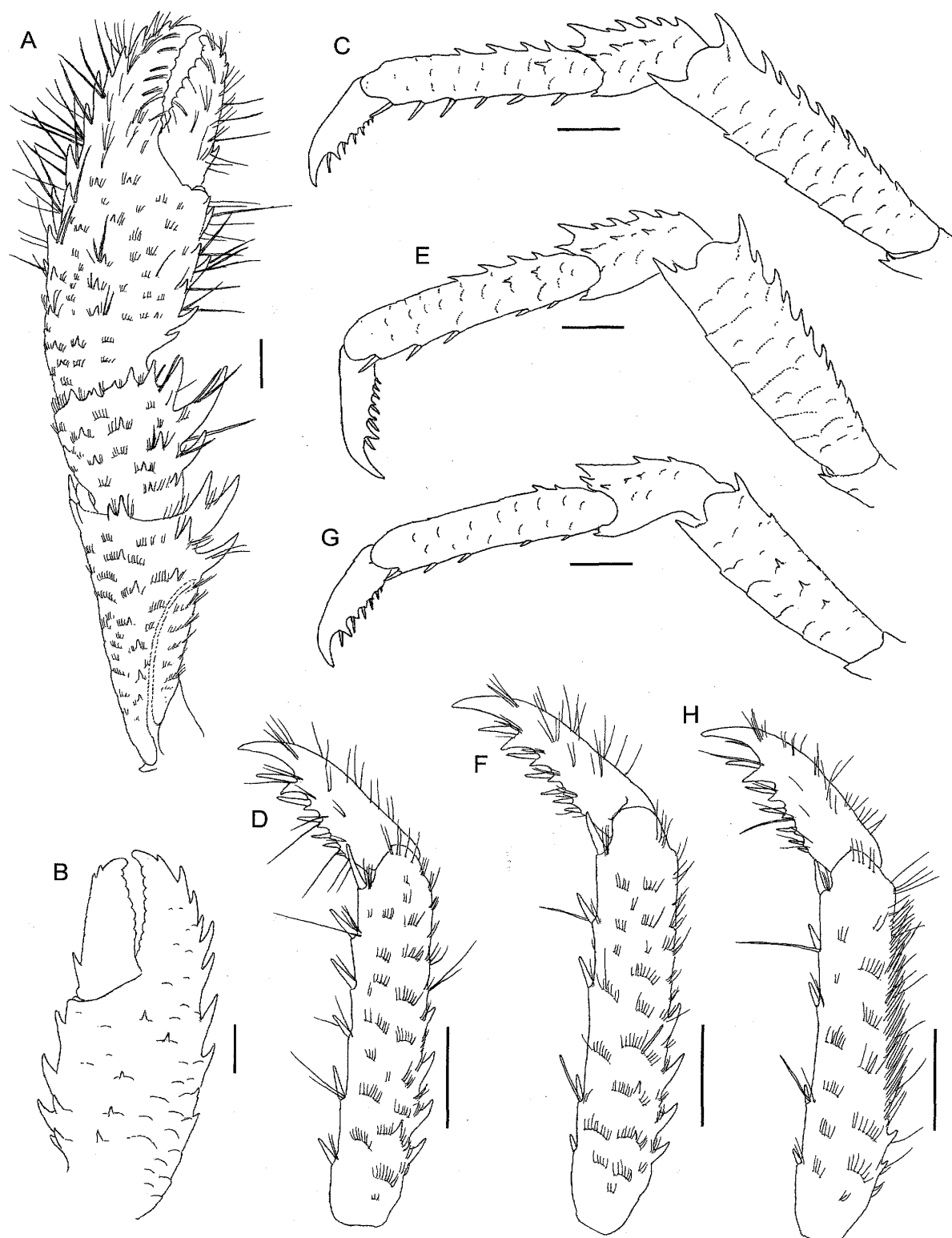


Fig. 2. *Galathea amboinensis* de Man, 1888, male (6.9 mm) from Maeda-misaki: A, P1, left, dorsal; B, same, distal part, ventral, setae omitted; C, P2, left, lateral, setae omitted; D, same, distal part, lateral; E, P3, left, lateral, setae omitted; F, same, distal part; G, P4, left, lateral, setae omitted; H, same, distal part. Scales = 1 mm.

tally. Article 1 of antennal peduncle with well-developed ventral distomesial spine overreaching article 2. Article 2 with distolateral spine larger than distomesial spine, exceeding beyond midlength and barely reaching end of article 3. Article 3 with small distomesial spine.

Mxp3 basis with 4–6 denticles. Ischium with distinct spine on flexor distal margin, extensor margin also with distal spine; crista dentata with 12–14 denticles. Merus as long as ischium, flexor margin with 2 strong spines, extensor margin with distinct distal spine and rarely 1 or 2 additional small spines proximal to it. Carpus unarmed.

P1 2.2–2.6 (females)–3.0 (males) times longer than carapace, relatively massive, with long stiff setae on ventral surface and along lateral and mesial margins. Merus 0.8–1.0 as long as carapace, 1.8–1.9 times length of carpus; 4–5 rows of spines, mesial spines strong, distal one of dorsomesial spines with accompanying spine on mesial margin (thus appearing bifurcate). Carpus 1.2–1.4 times longer than broad; 3 mesial spines of large size, median one prominent. Palm 1.7–2.3 (2.2–2.3 in males, 1.7–2.1 in females) times longer than broad, dorsal and ventral spines small, mesial and lateral spines strong, lateral spines continued on to entire length of fixed finger; carpus-palm length ratio 0.5 in males, 0.6 in females. Fingers 0.5–0.6 (males), 0.6–0.7 (females) length of palm, each distally ending in blunt, somewhat incurved spine; movable finger with 1 proximal and 2 subterminal spines on mesial margin; opposable margins not gaping.

P2–4 somewhat compressed, moderately setose, sparsely with long setae on distal three articles. Meri successively shorter posteriorly (P3 merus 0.8–0.9 length of P2 merus, P4 merus 0.8–0.9 length of P3 merus); breadth subequal on P2–4; length-breadth ratio, 4.4–6.3 on P2, 3.6–5.7 on P3, 3.1–3.6 on P4; merus-propodus length ratio, 1.3 on P2, 1.1 on P3, 0.9 on P4; P2 merus 0.8–0.9 as long as carapace; dorsal margin with 10–11 proximally diminishing spines on

P2, 9–12 spines on P3, 2 distal spines (proximal one much smaller) on P4; lateral surface with row of 3 spines on P4; ventromesial margin with terminal spine distinct on P2 and P3, obsolescent on P4. Carpi subequal, 0.4 length of propodi on P2–4; row of 6 or 7 spines on extensor margin and another row of 3 or 4 spines on lateral surface near extensor margin. Propodi subequal on P2 and P4, longer on P3; length-breadth ratio, 5.4–7.5 on P2, 5.4–8.0 on P3, 5.5–6.9 on P4; flexor margin with 4–6 movable spines on P2, 4–5 spines on P3, 2–4 on P4; extensor margin distinctly more setose on P4 than on P2 and P3, with 4–6 spines on P2, 3–5 spines on P3, 2 spines on P4; lateral surface with 0–2 proximal spines subparalleling extensor margin on P2–3, unarmed on P4. Dactylus 0.4 or slightly greater but not fully 0.5 length of propodus on P2–4; flexor margin with 5–7 proximally diminishing teeth, each with corneous spines.

Epipods present on P1–3.

Coloration.—See Fujita & Baba (1999: 113, fig. 1).

Remarks.—The material reported from the Moluccas (Baba, 1979) now in the collection of MNHN (Ga 1148) was reexamined on loan. The specimens from the Sulu Archipelago (Baba, 1988) and the Moluccas both have three spines on the anterior branchial margin. In the present material, the number of spines is two or three.

Recently Poore *et al.* (2008) recorded the occurrence of this species in SW Australia between 24°01'S–27°48'S, in 96–101 m. The color pattern they showed is exactly the same as that of the Ryukyuan material (Fujita & Baba, 1999).

### *Galathea continua*, new species (Figs. 3, 4, 8A, 8B)

*Galathea inflata*: Baba, 1979: 33, figs. 1, 2 (Amami-oshima, Ryukyu Islands, subtidal). — Fujita & Baba, 1999: 115 (part) (Okinawa, Ryukyu Islands, 6.2–8.3 m, on *Capillaster multiradiatus*, *Clarkcomanthus littoralis*, *Comatella maculata*, *Comatella nigra*, *Comatella stelligera*, *Comanthus* sp.; see under

the "Remarks" below). (Not *G. inflata* Potts, 1915)

Type material.—Holotype: MNHN-Ga 6678, female (4.2 mm), Mizugama, Okinawajima, Ryukyu Islands, on *Comatella maculata* (RUMF-ZE-00003), 7.6 m deep, 24.10.2001.

Paratype: MNHN-Ga 6679, 1 male (4.0 mm), same locality as for holotype, 6.0 m deep, *Comatella stelligera* (RUMF-ZE-00004), 05.04.2002; MNHN-Ga 6680, 1 female (5.8 mm), same locality, 6.8 m deep, *Comanthus gisleni* (RUMF-ZE-00005), 20.04.2002.

Description.—Carapace, exclusive of rostrum, 0.9–1.0 [0.9] times as long as broad; dorsal surface nearly horizontal from anterior to posterior; anterior cervical groove indistinct; 6 ridges on gastric region, anterior 2 (first and second) ridges medially convex anteriorly, first medially interrupted, third scale-like and placed medially, fourth uninterruptedly extending laterally to anterior-most of branchial marginal spines, sixth short; mid-transverse ridge uninterrupted, preceded by cervical groove, followed by 3 interrupted and 3 uninterrupted transverse ridges placed alternately (last interrupted ridge absent in small paratype). Lateral margins medially convex, with 8 spines: 2 spines in front of and 6 spines behind indistinct anterior cervical groove; first anterolateral, relatively small, distinctly posterior to level of lateral limit or orbit; second at midlength between anterolateral spine and anterior cervical groove, accompanying another small spine ventral to between first and second; 3 spines on anterior branchial region, and 3 spines on posterior branchial margin, last small. Lateral orbital angle ending in small spine; infraorbital margin anteriorly angular, with a few obsolescent lateral denticles. Rostrum broad triangular, 1.3–1.7 [1.4] times as long as broad, length 0.5–0.6 [0.5] that of, breadth 1/3 that of carapace, dorsal surface nearly horizontal in lateral view, with small setiferous ridges; lateral margin with 4 sharp teeth.

Pterygostomian flap rugose with sparse setae, anterior margin bluntly produced.

Sternal plastron 0.8–1.0 [0.8] times as long as broad, lateral limits divergent posteriorly. Sternite 3 (anterior spines excluded) 2.1–[2.7] times as broad as long, anterior margin medially produced, with V-shaped median notch flanked by distinct spine and a few denticles. Sternite 4 1.9–[2.0] times longer and 2.4–2.6 [2.4] times broader than preceding sternite, 0.3 as long as broad; surface with 2 transverse ridges bearing long setae, anterior one medially interrupted; posterior one uninterrupted, not reaching lateral margin. Following sternites smooth.

Abdominal somites 2–4 each with 2 uninterrupted transverse ridges on tergite, with or without interrupted ridge between; somites 5 and 6 each with 2 ridges, posterior ridge on somite 5 and both on somite 6 medially interrupted. Telson 0.7–0.8 [0.8] as long as broad, incompletely subdivided. Two pairs of male gonopods.

Ocular peduncles 1.3 times longer than broad; eyestalk (other than cornea) with short fine setae on dorsal anterior extension; cornea not dilated.

Basal article of antennular peduncle with 3 well-developed distal spines, distodorsal larger. Ultimate article with a few short setae not in tuft on distodorsal margin.

Article 1 of antennal peduncle hardly visible from dorsal view, with depressed ventral distomesial process not reaching distal margin of article 2. Article 2 with distolateral spine smaller than distomesial, reaching or [barely reaching] midlength of article 3. Article 3 with small, distinct distomesial spine. Article 4 unarmed.

Mxp3 basis with 4 or 5 denticles on mesial ridge, distal-most distinct, remainder very small. Ischium with well-developed distal spine on flexor margin; extensor margin unarmed; crista dentata with 19–23 [23] denticles. Merus subequal in length to ischium, with 2 (3 on left side in one paratype) strong spines of subequal size on flexor margin, proximal one located slightly distal to midlength, distal one at terminal end; exten-

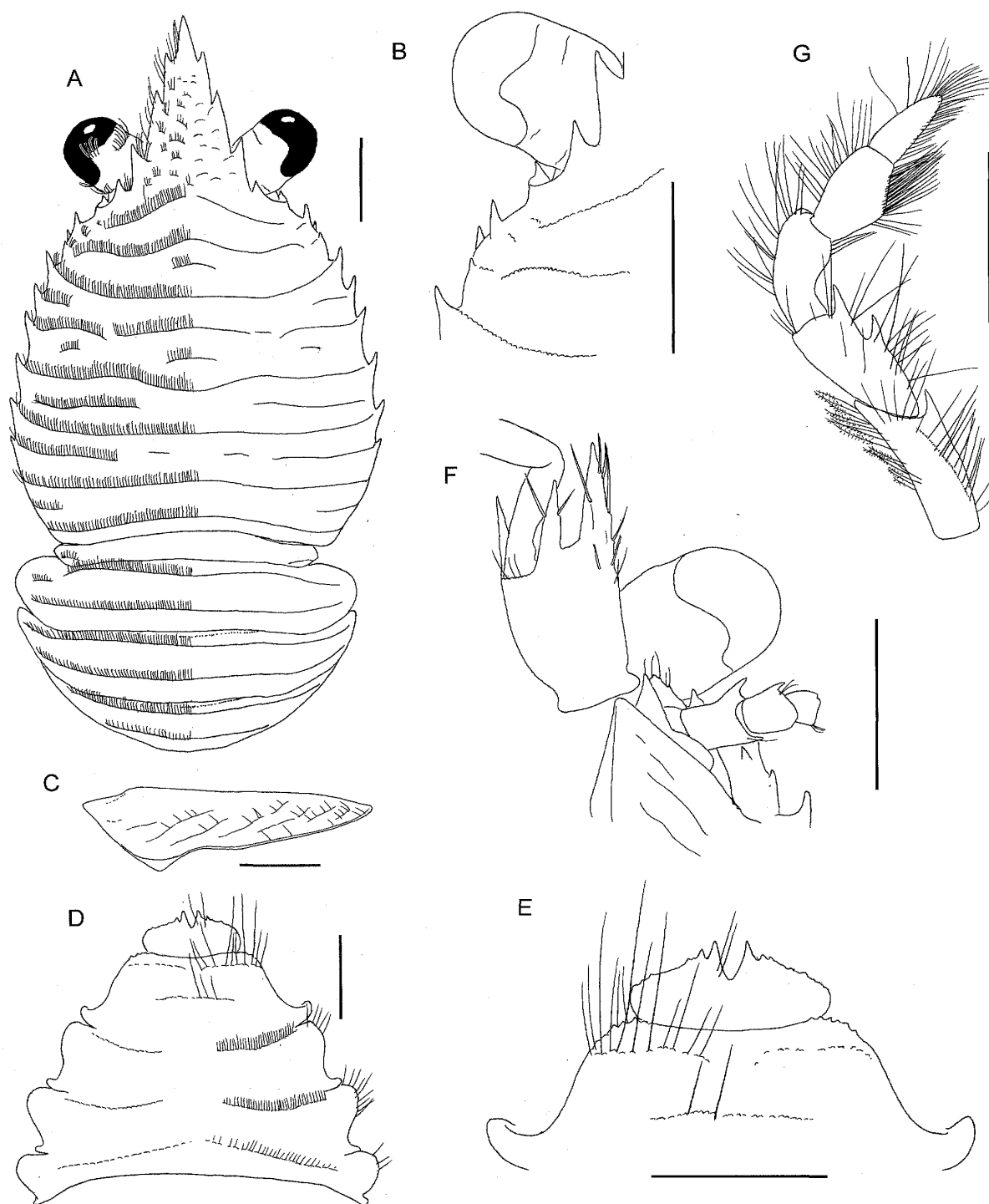


Fig. 3. *Galathea continua*, new species, holotype, female: A, carapace and anterior part of abdomen, setae omitted on right half, dorsal; B, anterolateral part of carapace, dorsal; C, pterygostomial flap, left; D, sternal plastron; E, same, anterior part; F, anterior part of cephalothorax, showing antennule and antenna, left, ventrolateral; G, Mxp3, right, lateral. Scales = 1 mm.

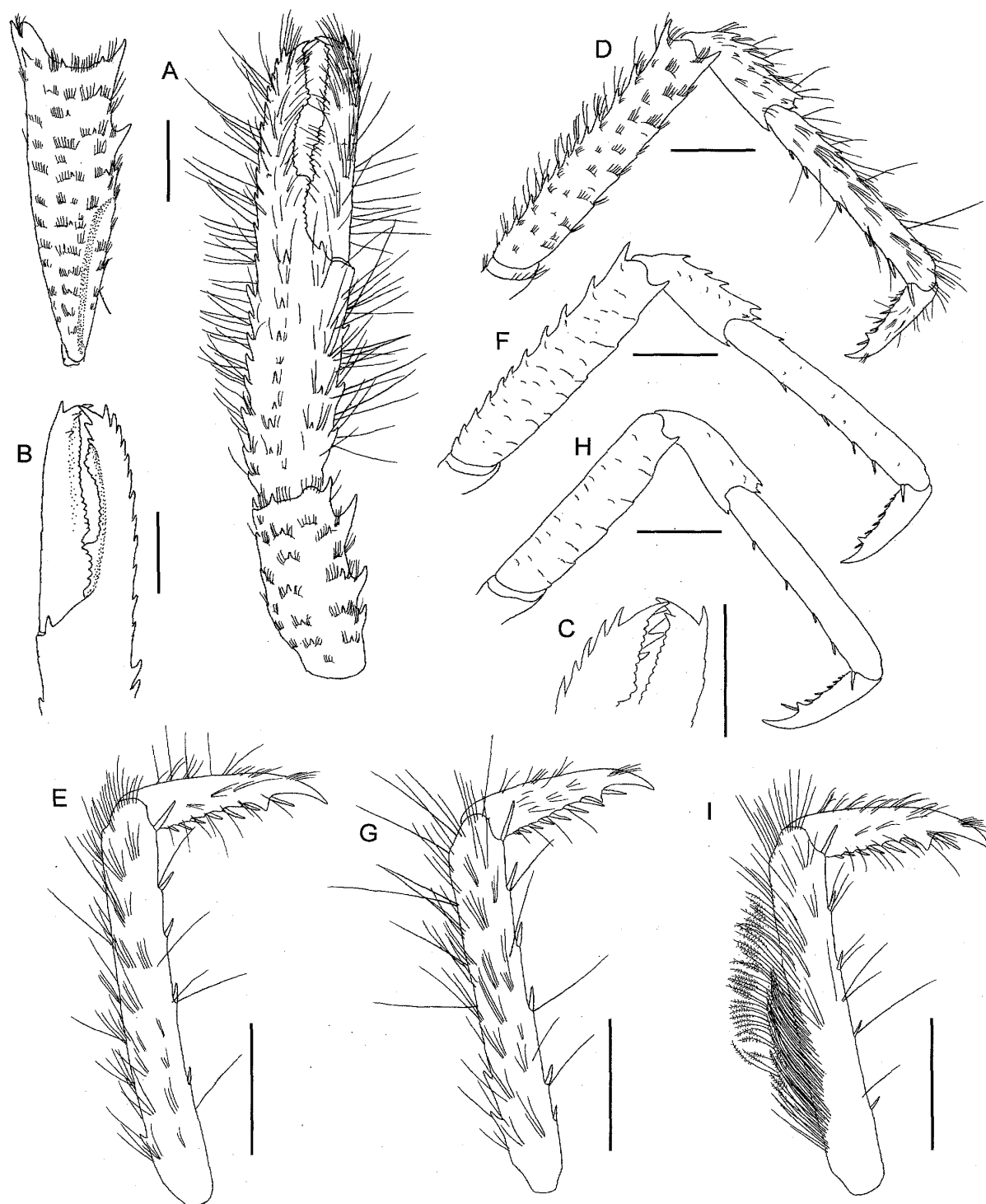


Fig. 4. *Galathea continua*, new species, holotype, female: A, P1, left, dorsal; B, same, fingers and distal part of palm, ventral; C, same, distal part of fingers, dorsal; D, P2, right, lateral; E, same, distal part; F, P3, right, setae omitted, lateral; G, same, distal part; H, P4, right, setae omitted, lateral; I, same, distal part. Scales = 1 mm



sor margin unarmed. Carpus spineless. Propodus [1.1]–1.3 times longer than carpus. Dactylus 0.7–[0.8] length of propodus.

P1 3.0–3.3 (males), 2.6–[3.2] (females) times postorbital carapace length, relatively slender, subcylindrical, with long stiff setae on ventral surface of all articles and along lateral and mesial margins of palm and fingers. Merus 0.9 times length of carapace, 1.5–[1.6] times as long as carpus, with 4 or [5] rows of spines: dorsomesial and ventromesial, both of strong spines, 1 or [2] dorsal and 1 ventral; and 2 additional large spines on distolateral margin. Carpus 0.7–0.8 [0.7] length of palm, 1.8–2.0 (males), 2.3 (females) times longer than broad, lateral and mesial margins subparallel in distal 2/3, dorsal surface with small spines in 2 longitudinal rows; mesial surface with 2 rows of well-developed spines placed dorsally and ventrally; and row of small spines along lateral margin. Palm 2.2–2.4 (males), 2.9–[3.0] (females) times longer than broad, lateral and mesial margins subparallel; spines roughly in 6 or [7] rows: 2 lateral (dorsolateral and ventrolateral), 1 or [2] dorsal (dorsomesial row of a few proximal spines), 1 mesial, and 2 ventral; dorsolateral row continued on to whole lateral margin of fixed finger. Fingers 0.87–0.97 (males), [0.86]–0.96 (females) as long as palm, distally crossing when closed (2 strong terminal spines of fixed finger accommodating opposing strong distal spine of movable finger between; opposable margins nearly straight or [somewhat gaping in median third]; when gaping, fixed finger with eminence at distal third and proximal third; mesial margin of movable finger with [1]–3 subterminal spines, unarmed elsewhere.

P2–4 relatively slender, somewhat compressed, moderately setose, sparsely with long setae on carpi and propodi. Meri successively shorter posteriorly (P3 merus 0.9 length of P2 merus, P4 merus [0.7]–0.8 length of P3 merus), equally broad on P2–4; P2 merus 0.9 carapace length, [5.6]–6.3 times as long as broad, [1.2]–1.4 times longer than P2 propodus; P3 merus 4.7–5.4

[5.1] times as long as broad, [1.0]–1.3 times length of P3 propodus; P4 merus 3.7–4.7 [4.5] times as long as broad, 0.93–1.00 [0.96] length of P4 propodus. Dorsal margins with row of 10–[13] proximally diminishing spines on P2–3, unarmed on P4; dorsolateral surface unarmed on P2–4; ventrolateral margins with strong terminal spine; ventromesial margin with terminal spine on P2 only. Carpi with [5] or 6 (on P2–3) and [2]–5 (on P4) spines on extensor margin, distal-most smaller; dorsolateral surface with row of [3] or 4 small spines paralleling extensor row on P2, none on P3–4; flexor distal margins with very small distal spine. Propodi subequal in length on P2 and P4, slightly longer on P3, each 6–[8] times as long as broad; extensor margin with 1–3 [2] proximal spines on P2, 0–2 [1] on P3, unarmed on P4; thick plumose setose along extensor surface on P4, not on P2 and P4; flexor margin with 5 [6 on left side of P2] slender movable spines on P2, 4 or [5] on P3 and P4, terminal one paired with another smaller spine mesial to it. Dactyli subequal in length, slightly less than half length of propodi, ending in incurved, strong, sharp spine; flexor margin with prominent triangular terminal tooth preceded by obsolescent 5–7 [6 or 7] teeth, each with seta-like movable spine.

Epipods present on P1, absent on P2–3.

Coloration.—Body and pereopods dark brown (Fig. 3A) or reddish brown (Fig. 3B) ground color, with 2 whitish or yellowish stripes on carapace extending backwards on to abdomen, convergent to join each other on telson; in large female paratype, additional yellowish stripe on each side of abdominal somites 2–4. P5 yellowish or brownish. P2–4 dactyli whitish in distal half.

Etymology.—From the Latin *continuus* (uninterrupted), in reference to the uninterrupted fourth transverse ridge of the carapace that laterally reaches the anterior-most spine on the branchial lateral margin, a character to separate the species from the other three species.

Remarks.—The material reported under *G. inflata* by Baba (1969) from Amami-oshi-

ma of the Ryukyus was reexamined. Without doubt, it is identical with the present species. *Galathea continua* is rather distantly related to the other three species described in this paper, in having epipods only on P1 instead of on P1–3 and no spine on the hepatic region lateral to the first transverse ridge of the carapace. It is also distinctive in the following: (1) the anterior fourth transverse ridge on the carapace is uninterrupted extending laterally to the anterior-most spine on the branchial lateral margin instead of being interrupted by the anterior cervical groove; (2) the sternite 3 has the anterior margin medially produced into two submedian spines flanking a small median notch, instead of two anteriorly convex lobes. The color pattern displayed by the new species is very much like that of *G. inflata*. However, the two whitish or yellowish stripes on the carapace are convergently continuous posteriorly on to the telson instead of joining each other on the entire abdomen.

The color patterns of *G. continua* and *G. inflata* are so similar that we suspected there might be misidentifications in our report of *G. inflata* (Fujita & Baba, 1999: Table 2). In fact, reexamination of that material showed that the large specimens (>3.3 mm in carapace length) found on *Capillaster multiradiatus*, *Clarkcomanthus littoralis*, *Comatella maculata*, *Comatella nigra*, *Comatella stelligera*, *Comanthus* sp. are referable to this new species. The small specimens are now poor in condition so as to be hardly identifiable, but those found on *Comanthus alternans*, *Stephanometra spicata*, *Tropiometra afra macrodiscus* possibly belong to *G. continua* although this identification needs confirmation. For the rest of the material, see below under the "Remarks" of *G. inflata*.

The material of Baba (1969) from Amami-oshima was recorded from a crevice of dead coral rock and it was probably caught while away from a host crinoid. According to Fujita & Baba (1999), comatulids usually live in crevices of coral reefs

and associated galatheids are often found on the substrate.

***Galathea inflata* Potts, 1915**  
(Fig. 5)

*Galathea inflata* Potts, 1915: 85, pl. 1, fig. 7 (type locality: Torres Strait, on *Comanthus annulatum* (currently either *Comanthus parvicirrus* or *Clarkcomanthus littoralis*; type material not located). — Baba, 1979: 649, fig. 2 (Banda Island, Gorong Island and Marsegu Island, subtidal, on *Comanthus parvicirrus*, *C. bennetti*, and *Comanthina schlegelii*). — Wu *et al.*, 1998: 92, figs. 10, 12G (Taiwan). — Fujita & Baba, 1999: 115 (part), fig. 2 (Okinawa, Ryukyu Islands, 2.0–9.8 m, on *Comanthus parvicirrus*, *Comaster schlegelii*, *Phanogenia gracilis*, *Comaster nobilis*; see under the "Remarks" below). — Fujita *et al.*, 2001: 112, figs. 1–12 (larvae) (Okinawa, Ryukyu Islands, subtidal, on *Comaster schlegelii*). — Kato & Okuno, 2001: 87, with fig. (Hachijo Island, Japan, 10 m, on comatulid crinoids). — Davie, 2002: 61 (no record). — Kawamoto & Okuno, 2003: 95, unnumbered fig. (Kumejima, Okinawa, 8 m, on crinoid). — Kawamoto & Okuno, 2006: 95, unnumbered fig. (Kumejima, Okinawa, 8 m, on crinoid).

Not *Galathea inflata*: Baba, 1969: 33, figs. 1–2 (Amami-oshima, Ryukyu Islands, subtidal) (= *G. continua* new species).

Material examined.—One female (5.8 mm), Mizugama, Okinawa-jima, 8.0 m deep, on *Comanthus parvicirrus*, date missing; 1 ovigerous female (5.7 mm), same locality, 6.7 m deep, on *Comaster schlegelii*, 03.04.1997; 1 male (5.7 mm), Maeda-misaki, Okinawa-jima, on *Comanthus parvicirrus*, 05.06.1997; 1 female (5.3 mm), same locality, 7.6 m deep, on *Comanthus parvicirrus*, 03.04.1997; 1 male (5.1 mm), same locality, 6.8 m deep, on *Comanthus parvicirrus*, 24.06.1999.

Diagnosis. —Carapace without epigastric spines; hepatic region with small but distinct spine lateral to first transverse ridge; spine between lateral orbital spine and anterolateral spine of carapace. Anterior branchial region bordered by anterior and posterior cervical grooves, with interrupted, scaly ridges; posterior half of carapace with 7

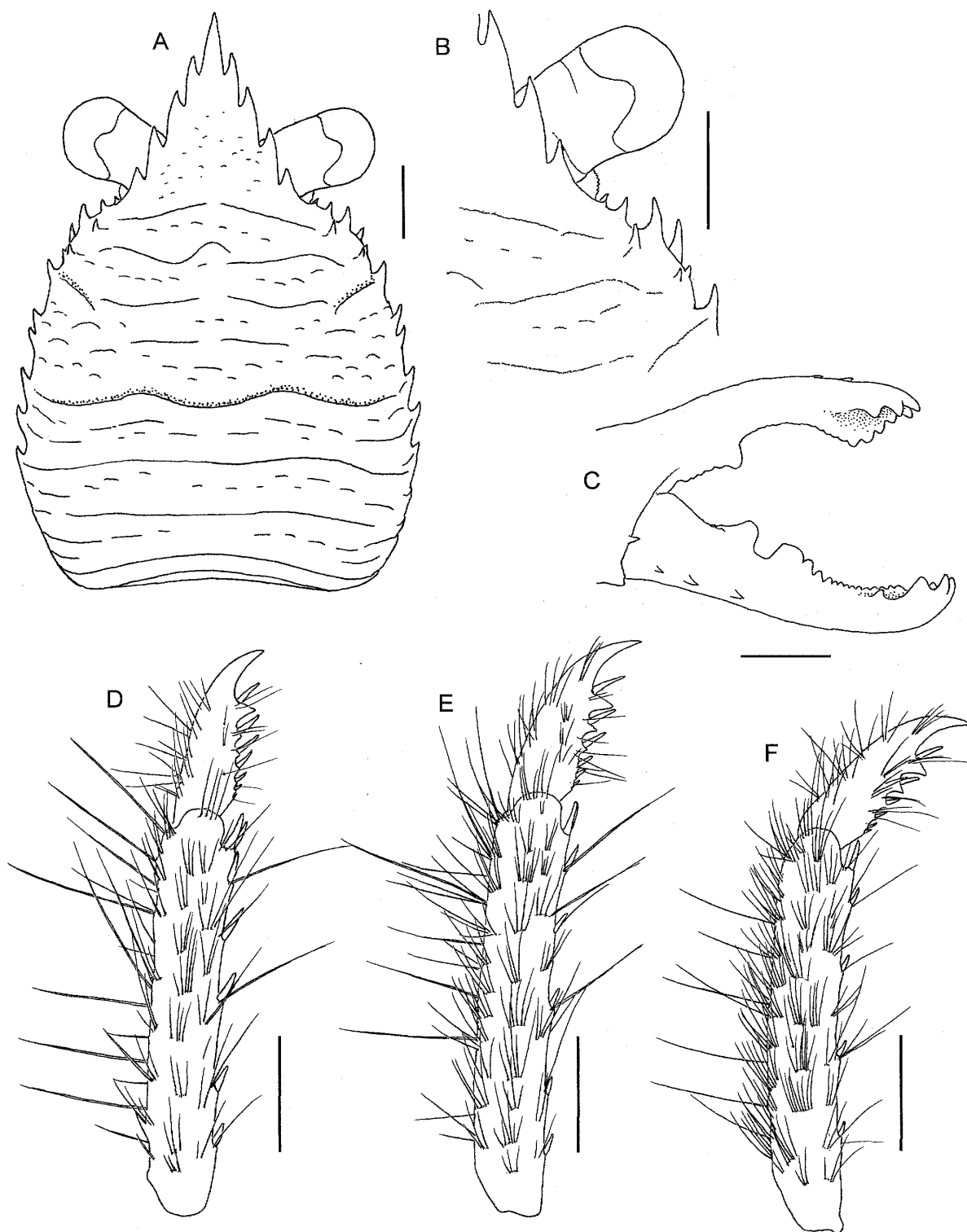


Fig. 5. *Galathea inflata* Potts, 1915, male (5.1 mm) from Maeda-misaki: A, carapace, dorsal; B, same, anterolateral part, right; C, P1 fingers, ventral; D, P2, distal part, right; E, P3, distal part, right; F, P4, distal part, right. Scales = 1 mm.

major transverse ridges: 4 uninterrupted and 3 interrupted ridges in alternate arrangement. Rostrum broad triangular. Sternite 3 bilobate on anterior margin. Abdominal somites 2–3 each with 2 transverse ridges on tergite. Basal article of antennular peduncle with 3 well developed distal spines, ultimate article with a few short setae. Mxp3 ischium with spine at flexor distal margin, unarmed on extensor distal margin; merus with 3 flexor marginal spines (proximal and distal strong, median small), and 2 extensor marginal spines. P1 slender; carpus and palm each about 3 times longer than broad; fingers distally spooned, with intermeshing teeth. P2–4 with stiff long setae on carpi and propodi; propodi slightly longer on P3 than on P2 and P4, slightly more thickly setose on P4 than on P2 and P3. Epipods on P1–3. Male gonopods on abdominal somite 2 only.

Coloration.—See Fujita & Baba (1999: 117, fig. 2).

Remarks.—The male of the species is unique in the genus in having no gonopods on the abdominal somite 1. The carapace shape and spination are very much like those of *G. amboinensis* and *G. leptochair*, but P4 propodi are different. In *G. inflata*, the propodus is slightly more thickly setose on P4 than on P2 and P3, whereas in *G. amboinensis* and *G. leptochair*, it is pronouncedly setose. The species is distinguished from *G. amboinensis* by the following: (1) the branchial region bears scaly instead of continuous ridges; (2) tergites of abdominal somites 2–3 each bears two instead of three transverse ridges; (3) the Mxp3 merus bears three (median small) instead of two spines on the flexor margin; (4) the Mxp3 ischium is unarmed instead of bearing a distinct spine on the extensor distal margin; (5) P1 fingers distally are spooned, with intermeshing teeth instead of distally ending in incurved spines to cross when closed, and (6) the movable finger is subterminally unarmed instead of a few spines on the mesial margin.

Coloration is clearly different between *G. inflata* and *G. amboinensis*. *Galathea inflata*

has two whitish or yellowish stripes and three dark brown or dark green stripes on the carapace and three whitish or yellowish stripes and two dark stripes on the abdomen, whereas *G. amboinensis* has four whitish and five dark brown stripes on the carapace, both continued on to the abdomen. In addition, the P1 is uniformly dark brown or dark green in *G. inflata*, instead of bearing dark brown bands as in *G. amboinensis*.

The relationships with *G. leptochair* are discussed under the “Remarks” of that species (see below).

Reexamination of the material of *G. inflata* reported by Fujita & Baba (1999: 116, Table 2) revealed that all the specimens found on *Comanthus parvicirrus*, *Comaster schlegelii*, three specimens on *Phanogenia gracilis* (collected 29.08.1996 and 14.11.1997) and one specimen on *Comaster nobilis* (collected 26.08.1997) were correctly identified. The other specimens from *Capillaster multiradiatus* and *Tripiometra afra macrodiscus* (collected 12.05.1995) are now poor in condition, and may be referable to either *G. inflata* or *G. continua*. For the rest of the material, see above under the “Remarks” of *G. continua*.

***Galathea leptochair*, new species**  
(Figs. 6, 7, 8C, 8D)

Type material.—Holotype: MNHN-Ga 6681, 1 male (3.0 mm), Maeda-misaki, Okinawa-jima, Ryukyu Islands, 8.3 m deep, on *Phanogenia gracilis* (RUMF-ZE-00006), 12.06.1999.

Paratypes: MNHN-Ga 6682, 1 female (4.1 mm), Maeda-misaki, Okinawa-jima, 9.4 m deep, on *Phanogenia gracilis* (RUMF-ZE-00007), 12.08.2000; MNHN-Ga 6683, 1 female (6.3 mm), same locality, 15.6 m deep, on *Phanogenia gracilis* (RUMF-ZE-00008), 15.03.2003; MNHN-Ga 6684, 1 female (6.8 mm), same locality, 16.5 m deep, on *Phanogenia gracilis* (RUMF-ZE-00009), 26.03.2003; MNHN-Ga 6685, 1 female (6.2 mm), Mizugama, Okinawa-jima, 6.4 m deep, on *Phanogenia gracilis* (RUMF-ZE-00010),

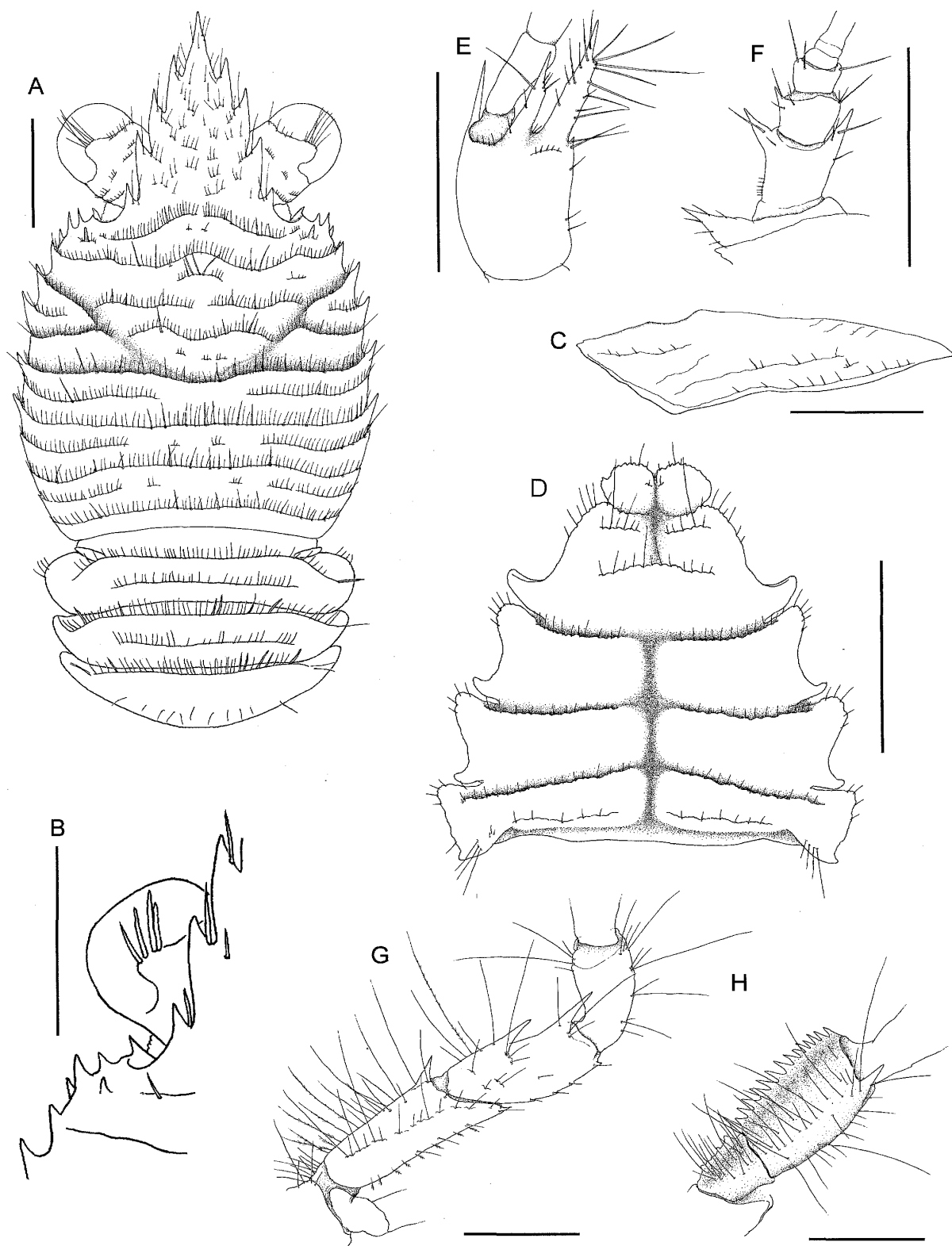


Fig. 6. *Galathea leptochair*, new species, holotype, male: A, carapace, dorsal; B, same, anterior part, dorsal; C, pterygostomian flap, left; D, sternal plastron; E, antennule, left, ventral; F, antenna, left, ventral; G, Mxp3, left, lateral; H, same, ischium, ventral. Scales = 1 mm.

30.04.2007.

**Description.**—Carapace, exclusive of rostrum, 0.9 times as long as broad; dorsal surface nearly horizontal from anterior to posterior; transverse ridges with sparse stiff setae among short fine setae; cervical groove distinct, laterally bifurcated; 6 ridges on gastric region, anterior first and second ridges medially convex anteriorly, third scale-like or as concentric arc, placed medially, flanked by another short ridge [left ridge missing], fourth straight, medially uninterrupted or interrupted [uninterrupted], fifth nearly straight or somewhat sinuous [sinuous], uninterrupted, sixth uninterrupted or interrupted [interrupted]; hepatic region with small spine lateral to first transverse ridge; epigastric region without spines; anterior branchial region with distinct ridges; mid-transverse ridge uninterrupted, preceded by shallow cervical groove, followed by 3 interrupted and 3 uninterrupted transverse ridges placed alternately. Lateral margins well convex medially, with 7 spines: 2 spines in front of and 5 spines behind anterior cervical groove; first anterolateral, accompanying small spine mesial to it, second small, located at midlength between first spine and anterior cervical groove; 2 spines on anterior branchial margin, and 3 spines on posterior branchial margin, last small or obsolescent; additional spine ventral to between first and second lateral spine. Lateral orbital angle with small spine; infraorbital margin moderately angular anteriorly, minutely denticulate along lateral margin. Rostrum broad triangular, 1.3–1.5 [1.4] times as long as broad, length 0.5 postorbital carapace length and breadth [0.3]–0.4 that of carapace, nearly horizontal in lateral view; dorsal surface with small setiferous ridges; lateral margin with 4 deeply incised sharp teeth, each bearing relative stiff long setae on mesial base.

Pterygostomian flap rugose, with sparse short setae, anterior margin bluntly angular.

Sternal plastron about as long as broad, lateral extremities gently divergent posteriorly. Sternite 3 twice as broad as long, with

median depression bordering left and right lobes, anterior margin of each lobe convex, with minute dentitions. Sternite 4 [1.9]–2.2 times longer and 2.6–[2.7] times broader than sternite 3, 0.4 as long as broad; surface with 2 setiferous transverse ridges, anterior one medially interrupted; posterior one uninterrupted, not reaching lateral margin. Following sternites smooth but feeble transverse ridge medially interrupted on sternite 7.

Abdominal somites 2–3 each with 2 transverse ridges on tergite, with or without additional interrupted ridges between, anterior ridge more distinctly elevated than posterior ridge; tergite of somite 4 with anterior ridge only; somite 5 with 1 or 2 medially interrupted, obsolescent ridge or devoid of ridges [devoid of ridge] on tergite, distinct ridge on pleura; tergite of somite 6 with 2 medially interrupted ridges, posteromedian margin nearly transversal with setiferous ridge, all these ridges with posteriorly directed fine setae. Telson [0.7]–0.8 as long as broad, incompletely subdivided. Male gonopods on abdominal somites 1–2.

Ocular peduncles 1.3 times longer than broad; eyestalk (other than cornea) with lateral margin somewhat convex, dorsal anterior extension with several (5–7) stiff setae; cornea not dilated.

Basal article of antennular peduncle with well-developed distodorsal and distolateral spines, distodorsal larger; distomesial spine also well developed, subequal in length to but somewhat more slender than distolateral. Ultimate article with a few short fine setae not in tuft on distodorsal margin.

Antennal peduncle with article 1 hardly visible in dorsal view, with ventral distomesial spine barely reaching distal margin of article 2. Article 2 with 2 well-developed distal spines, distolateral spine overreaching midlength of but barely reaching end of article 3, distomesial spine subequal to distolateral. Article 3 with distinct distomesial spine. Article 4 unarmed.

Mxp3 basis with 5 denticles on mesial ridge, distal larger. Ischium with well-devel-

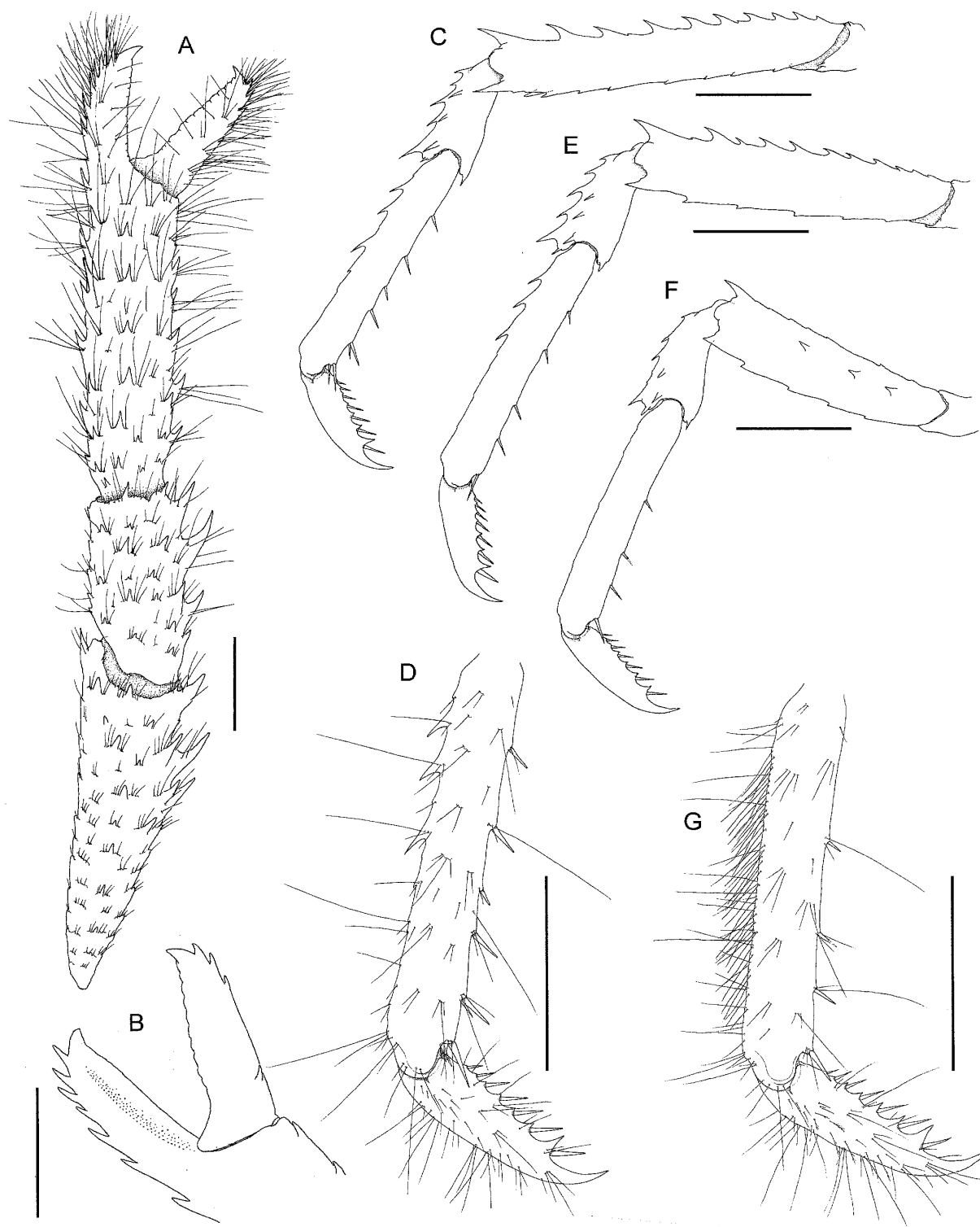


Fig. 7. *Galathea leptochair*, new species, holotype, male: A, P1, left, dorsal; B, same, distal part, right, ventral; C, P2, left, setae omitted, lateral; D, same, distal part, lateral; E, P3, left, setae omitted, lateral; F, P4, left, setae omitted, lateral; G, same, distal part, lateral. Scales = 1 mm.

oped distal spine on flexor margin; extensor margin with small but distinct distal spine; crista dentata with 14–20 [18] denticles. Merus equally long as ischium; flexor margin with 2 strong spines of subequal size, proximal one located at midlength, distal one at terminal end (in one paratype female, additional small spine between, on right side); extensor margin with obsolescent distal spine. Carpus unarmed. Propodus 1.2–[1.3] times length of carpus. Dactylus [0.5]–0.7 length of propodus.

P1 [3.5]–3.6 (females), 3.5 (male) times postorbital carapace length, relatively slender, subcylindrical, somewhat depressed on palm, more so on fingers, and spinose, with sparse long setae. Merus 1.1–1.3 [1.2] times length of carapace, 1.7–[2.0] times as long as carpus, with spines arranged roughly in 5 or 6 rows: 1 dorsomesial, 1 ventromesial, [1] or 2 dorsal, and 2 ventral; dorsomesial and ventromesial stronger; distal spines prominent. Carpus 0.6 length of palm, [2.0]–2.3 times as long as broad (breadth measured at midlength); dorsal surface with small spines arranged roughly in 3 longitudinal rows continued on to palm; mesial margin with 3 or 4 strong spines (distal second largest). Palm [3.6]–4.0 times longer than broad, lateral and mesial margins subparallel; spines arranged roughly in 6 or 7 rows: 1 dorsolateral, 1 ventrolateral, 1 or [2] dorsal (mesial row of a few proximal spines), 1 dorsomesial, 1 ventromesial, and 1 or 2 ventral; dorsolateral row of larger spines continued on to whole lateral margin of fixed finger. Fingers slightly less than half length of palm, each distally ending in incurved spine, without intermeshing spines; opposable margins nearly straight, with blunt serration; mesial margin of movable finger with 2 or [3] spines distally and 1 proximal spine rather ventral, barely discernible in dorsal view.

P2–4 moderately slender, with long sparse setae. Meri successively shorter posteriorly (P3 merus 0.9 length of P2 merus, P4 merus 0.8 length of P3 merus); P2 merus subequal to carapace length, 5.7–6.6 [5.9]

times as long as broad, slightly narrower than P3 merus, 1.4 times longer than P2 propodus; P3 merus 4.7–5.0 [4.5] times longer than broad, equally broad as P4 merus, 1.1–[1.2] times longer than P3 propodus; P4 merus 3.9–[4.0] times as long as broad, 0.9–[1.0] length of P4 propodus. Dorsal margins with row of 10–13 [11–12] proximally diminishing spines on P2–3, distal spine only on P4; dorsolateral surface unarmed on P2–3, with row of [3] or 4 spines on P4; ventrolateral margin distally ending in strong spine followed proximally by small spine and several tubercles or eminences; ventromesial margin with terminal spine distinct on P2, obsolescent on P3–4. Carpi with 6 or 7 spines on extensor margin on P2–3, 5–6 spines on P4, distal-most smaller than distal second; dorsolateral surface with 3 or 4 spines sub-parallelizing extensor margin on P2–3, 2 spines on P4; flexor distal margin with very small distal spine. Propodi subequal in length on P2 and P4, slightly longer on P3, each 7 times as long as broad; extensor margin with 3–[5] spines on proximal half on P2 and P3, unarmed or [with 1 proximal spine], and thickly setose along entire length on P4; flexor margin with 5 or [6], 4 or [5], 4 or [5] slender movable spines on P2, P3, P4 respectively, terminal one paired with another smaller spine mesial to it. Dactyli subequal in length, distally ending in well-curved strong spine, length slightly less than that of propodi; flexor margin with 7–8 proximally diminishing teeth, each with seta-like movable spine.

Epipods on pereopods 1–3.

Coloration.—Two color patterns are observed.

Color pattern 1 (Fig. 8C): Body pale-yellow ground color, dorsally with 3 longitudinal narrow stripes of reddish brown, one in midline on entire length (from rostrum to telson), others on lateral portions of carapace, extending backwards, interrupted on abdominal somite 1, convergent toward somite 4, and again divergent between somite 5 and uropods. Pereopods yellowish orange, spines reddish brown. Observed in



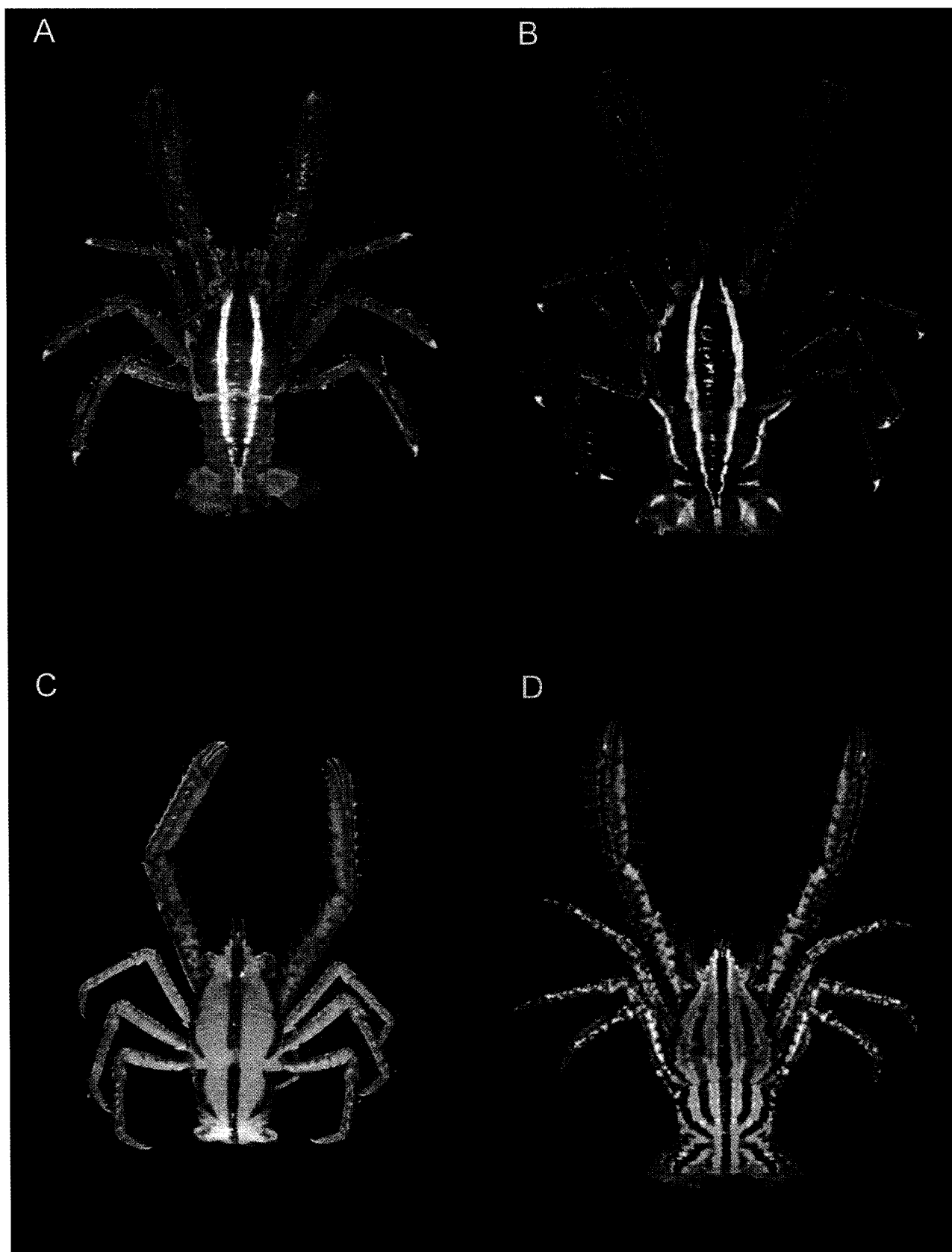


Fig. 8. A, B, *Galathea continua*, new species; C, D, *G. leptochair*, new species: A, paratype, male (4.0 mm), MNHN-Ga 6679; B, paratype, female (5.8 mm), MNHN-Ga 6680; C, holotype, male (3.0 mm), MNHN-Ga 6681; D, paratype, female (6.2 mm), MNHN-Ga 6685.

small specimens, 3.0 mm (male), 4.2 mm (female).

Color pattern 2 (Fig. 8D): Body light yellowish white, with reddish brown stripes like pattern 1, plus additional stripes between median and lateral stripes. Pereopods with light yellow blotches. Observed in larger females other than the above specimens.

Etymology.—The specific name is a noun in apposition from the Greek *leptos* (slender) and *cheir* (hand), referring to the slender cheliped that separates the new species from *G. amboinensis*.

Remarks.—The species is very closely related to *G. amboinensis* de Man, 1888 in nearly all aspects but can be separated by the following: The third ridge on the carapace is scale-like or forming a concentric arc placed in the middle instead of interruptedly or uninterruptedly extending laterally; the posterior half of the carapace bears four uninterrupted and three interrupted transverse ridges instead of six uninterrupted and one interrupted ridge; the Mxp3 merus bears an obsolescent instead of a distinct spine on the extensor distal margin; the P1 is much more slender in the new species: the palm is 3.6–4.0 times instead of 1.7–2.3 times longer than broad; the carpus is 2.0–2.3 instead of 1.2–1.4 times longer than broad.

The species is also resembles *G. inflata* Potts, 1915 in the ornamentation of the anterior carapace but it is distinguished from that species by (1) male gonopods are present on abdominal somites 1 and 2 instead of only on somite 2; (2) the anterior branchial region bears continuous instead of scaly ridges on the dorsal surface, and with two instead of three lateral spines; (3) the Mxp3 merus bears two subequal, well-developed instead of three (median small) spines on the flexor margin, and an obsolete terminal instead of two distinct spines on the extensor margin; (4) the P1 fingers distally bear incurved blunt spines to cross to each other when closed, instead of being distally spooned with several blunt intermeshing teeth; (5) the movable finger bears two or

three spines instead of being unarmed on the distal portion of mesial margin; (6) the P4 propodus bears thick plumose instead of sparse simple setae along the extensor margin.

The color pattern displayed by the larger females of *G. leptochair* is much like that of *G. amboinensis*. The dark stripes on the carapace and abdomen are reddish brown in *G. leptochair*, dark brown in *G. amboinensis*; and the P1 in *G. amboinensis* bears dark brown bands, which are missing in *G. leptochair*.

Key to the four crinoid-associated species of  
*Galathea* found on coral reefs of the  
Ryukyu Islands

1. Epipods on P1 only, not on P2–3. Hepatic region without spine lateral to first transverse ridge of carapace. Two whitish or yellowish stripes on carapace continued on to abdomen ..... *G. continua*
- Epipods on P1–3. Hepatic region with spine lateral to first transverse ridge of carapace ..... 2
2. Male gonopods on abdominal somite 2 only. Anterior branchial region with scaly ridges. Mxp3 merus with 3 spines (proximal and distal spines strong, median small) on flexor margin. Two whitish stripes on carapace and 1 same stripe in midline on abdomen ..... *G. inflata*
- Male gonopods on abdominal somites 1 and 2. Anterior branchial region with continuous ridges. Mxp3 merus with 2 strong spines on flexor margin ..... 3
3. Posterior half of carapace with 7 major transverse ridges, sixth ridge interrupted, remainder uninterrupted. P1 palm about twice as long as broad, carpus 1.2–1.4 times longer than broad; with dark brown bands ..... *G. amboinensis*
- Posterior half of carapace with 4 uninterrupted and 3 interrupted transverse ridges arranged alternately. P1 palm about 4 times longer than broad, carpus 2.0–2.3 times longer than broad; yellowish orange or with light yellow blotches, without bands ..... *G. leptochair*

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